Generative Language Modeling for Automated Theorem Proving

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Abstract

We explore the application of transformer-based language models to automated theorem proving. This work is motivated by the possibility that a major limitation of automated theorem provers compared to humans -- the generation of original mathematical terms -- might be addressable via generation from language models. We present an automated prover and proof assistant, GPT-f, for the Metamath formalization language, and analyze its performance. GPT-f found new short proofs that were accepted into the main Metamath library, which is to our knowledge, the first time a deep-learning based system has contributed proofs that were adopted by a formal mathematics community.